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ABSTRACT

Attention is being directed to telecommunications and computer technologies as a possible way of delivering education to small rural schools in a cost-effective way. Characteristics of new technology and environmental changes having particular relevance for rural schools include the abilities to transcend space, network, redefine learning as dynamic and interactive, and stimulate innovations and creativity. While adoption (purchase) of educational technologies is occurring quickly, the rate of creative application (use) depends upon whether the technology: can be tried first on a small scale; has compatability with existing behaviors and practices; is simple; has low cost and high effectiveness; and has a support system. Because of their small size and flexible, adaptive natures, rural schools--especially in Alaska and Australia--are becoming innovators in applications of technolgy and in networking. The Oklahoma State University Arts and Science Public Schools Teleconferencing Network and the Utah Department of Education Accelerated Learning of Spanish by Satellite programs involve state-of-the-art technology and share similar methodology, purpose, and delivery systems. Their use of multiple technologies, collaboration, and coordination represent important steps in addressing rural education's need to take cost-effective advantage of quality educational resources that fill a specific curriculum need. but are located elsewhere. (NEC)

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By

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University of Missouri-Columbia

National Rural Education Forum

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Paper prepared for the U.S. Department of Education 1985 National Rural Education Forum held in Kansas City, Missouri, August 1985.

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The rural education problem has always been closely linked with space and economics. The traditional view of the school is very much space bound. This has been, and is, an important feature of the American notion of the community school. The view has prevailed that all the educational resources needed for a comprehensive program were to be located at the school site and under the direct management of each school system. This included all the teachers, counselors, administrators, library books, texts, and other educational materials.

As the educational enterprise expanded and public expectations of schools increased, economics became an important consideration in what a school could offer. If the resource and student base of a school were small, economics dictated that the educational offerings of the school would be correspondingly small.

The first response to this rural education problem was consolidation-- combining several schools to increase the resource and student base in order to economically expand educational offerings. Supporting the consolidation approach were the industrial-era concepts of centralization and standardization and their presumed relationship to organizational and cost effectiveness. But consolidation produced costs as well as benefits-- social and economic costs to communities that lost schools, and costs to both the school and students associated with greater travel. In addition, despite the 1970's rural population

"turnaround" that added substantial population to many rural localities, a continuing decline in numbers of students still affects many of the nation's rural schools. Declining numbers of students, increased travel costs, and lack of public support combine to make consolidation an outmoded strategy for solving the traditional rural school "problem" in most parts of the country.

So many rural schools have shifted to other strategies to cope with the economic-space-program problem. Preeminent among these approaches has been sharing teachers, staff or service among schools (for example, Weible, et al., 1983). But in the past few years, more attention is being directed to telecommunications and computer technologies as a possible way of delivering education to small rural schools in a cost effective way. The potential of these technologies to contribute to solution of the chronic, small rural school "problem" is the focus of this paper.

But at the same time that new technologies have been emerging, complications have been added to the rural school "problem." There is the matter of increased public concern with the performance of education generally, highlighted by publication of A Nation at Risk; most colleges and universities are increasing their graduation requirements: new job skills are being demanded in the transition to an "information age" society; the oversupply of teachers of a few years back is being replaced by an expected teacher shortage in many subject areas; and economic and agricultural changes are shrinking the tax base of many

rural localities. Improved educational effectiveness has been added to maintaining efficiency as a component of the rural school problem.

Persistence of the rural small school problem along with dramatic changes in technology, with even more significant developments expected, combine to make this a time of experimentation and innovation in rural schools. Having nearly reached the limits of consolidation as a solution to the problem, more attention is being focussed on technology and organizational innovations.

It is the purpose of this paper to review recent technological developments and how these are being experimented with among rural schools. Our attention will concentrate on computer and telecommunications technologies, although these do not exhaust the range of innovations being undertaken by rural schools today. For purposes of this discussion, we phrase the rural education "problem" as follows: to be able to take advantage of quality educational resources, in a cost effective way, that fill a specific curriculum need, but are located somewhere else. Like urban schools, rural schools can benefit from incremental refinements to their curriculum that new technologies are producing, yet beyond that rural schools differ in that they need entire additions to their curriculum-- whole chunks provided in non-traditional ways. That is just one of several reasons we will cite why we expect technology to play a different and probably larger role in rural that in urban education. At a minimum, the rural problem is different; but it is a problem for which new technology may be appropriate.

Technology and Rural Education

We generally have a utilitarian view of technology. We usually use that term to refer to technical changes that enable increasing productivity or solving problems. Technology is used more often in conjunction with medicine, industry, agriculture and other product oriented fields than in relation to art, leisure, interpersonal relations, etc. One can notice, however, the intrusion over the past twenty years of technology into the education literature. The intrusion has been amplified in recent years by the development of technologies which offer the possibility of educational alternatives to the traditional teacher in the classroom.

The ERIC file, for example, includes more than 18,000 references having technology as a focus.

But the linkage of technology with education is not new. Significant advances in transportation technology enabled and supported rural school consolidation; technical changes in the workplace produced a major commitment to vocational education. These, and others that could be cited, contributed to restructuring how, where, and what education was offered.

Education is now confronted with a plethora of technologies that have restructuring potential. In addition, society and the clientele being served are also changing in fundamental ways. As suggested by Toffler, we have reached the end of the mass society era and will need

new, dramatically altered institutions capable of operating in a de-massified environment. Some features of new technology and environmental changes having particular relevance for rural schools include:

Transcending Space.--Overcoming the "friction of space" is fundamental to the rural school problem. But as noted by Fletcher (1980), modern telecommunications (and we might add computer) technology is more independent of geographic constraints than any other service delivery mechanism. Or as suggested by Kay (1982), new technology makes possible the substitution of communication for transportation--it is cheaper to transport information than to transport people. This promises to be a restructuring idea as the full implications for education, health care, government services, etc., are developed.

Networking.--Closely associated is the capability of new technologies for networking, e.g., gaining access to data bases, educational resources, etc., for electronic transfer of information AND interaction. We will emphasize later that microcomputer technology may have greater value for rural schools as a communicator than as a calculator.

Redefining Learning.--While we are still very much in an experimental stage in applying computer technology to education, there is a vision of a changed mode of learning. There is anticipation of shifting the locus of teaching interest from content to process, or of

redefining knowledge as dynamic and interactive rather than static and bound (McDonald and Thompson, 1984; McCune, 1982).

Stimulating Innovations and Creativity.--As suggested by Annisan (1982), a transition is occurring from a world of "either-or" (either sick or well, employed or unemployed, a student or not) to a world of multiple options. He points out that "Now education and instruction exist in an almost infinite variety of forms ranging from traditional education to on-the-job training, to a host of personal development programs." (1982:7)

Because microcomputers and telecommunications are generic technologies, they can be dedicated to the service of a wide range of educational possibilities. Reviewing the recent rural education-technology literature reveals that an abundance of creative adaptations are being made. The creativity comes not so much from acquiring the technology as much as determining the uses that will be made of it. A consequence appears to be some erosion of the standardization and centralization that have characterized public education in the recent past. There appears to be no "one best system" notion of how, and for what purposes, technology should be incorporated into the school. That is a situation ripe for new ideas.

Diffusion of Technology

There are two sides to the technology question. One is concerned with the adoption of educational technologies, that is, buying it. The other involves creative applications of technology--using it. Computers and telecommunications technology is different from some other technology we experience in that they are not limited to a small or prescribed use. How much and what impact on the curriculum is not assured with the purchase of the equipment. That is why we draw a distinction between adoption and application. Especially for computers, adoption is occurring quickly; creative applications are proceeding more slowly. Some exciting experiments are underway, however, which will be discussed at the conclusion of the paper.

Computers especially are a generic technology--they can add relatively small bits of marginal utility over typewriters, adding machines and flashcards. With continually declining prices, their use as a substitute for typewriters and adding machines is justifiable. But computers can also be used for purposes which heretofore would have been difficult if not impossible, e.g., complex simulations, electronic access to large data bases, etc. When thinking about the range of potential uses of microcomputers, whether or not they represent an educational innovation depends more on how they are used, than whether there are any present in the school.

It is not surprising that most schools have joined the ranks of those purchasing computers, i.e., adopting the technology. Years of accumulated research of the adoption of agricultural technology (Rogers, 1983) has demonstrated that the rate of adoption of any specific practice depends to an important degree on various characteristics of the technology. It has been shown, for example, that technologies are more quickly adopted: (1) if they are divisible--you can try it on a small-scale before going whole hog--you can buy one computer and try it out before computerizing the school; (2) if they are compatible with existing behaviors and practices--computers type, add, and hold up flashcards, which school are already doing--you can use computers for existing purposes without changing much behavior; (3) if the technology is simple rather than complex--computers were complex, they have become simple, you can even get a mouse to do the work; (4) if the cost is low--computers were very expensive, they are now relatively cheap; (5) if the technology is effective--word processing is an important advance over typing, and as a flashcard holder the computer is more patient than any of us; and (6) whether there is a support system for the technology.

The rapid growth of a commercial support system is clear. In addition, Hutchins (1982) emphasizes that the impetus for the computer movement "...has come from outside the schools...previous technological innovations such as teaching machines and educational television failed to gain widespread use because they were not reinforced by these outside forces." To this support system can be added pressure from parents and communities.

There have been few barriers to schools purchasing computers. Most of the cards have been stacked on the side of schools (including small rural ones) buying computers. Some important barriers, however, still stand in the way of integrating technology into the curriculum and, for that matter, turning some parts of the curriculum over to technology. A school may have computers that never find their way into the classroom, and still have no trouble justifying the expenditure. However, even if some classrooms are adorned with IIe's, PC's, etc., there are still three quite different ways they might be used: teaching about computers, teaching with computers, or teaching by computer. Most schools (rural and urban, especially urban) are teaching about computers, a majority appear to be teaching with computers (CAI), and yet only small rural schools appear to have a need to find ways of offering a part of their curriculum by computers. It is being done, and in some very imaginative ways, but not significantly as a stand-alone machine--computer technology is being combined with other technologies and different concepts of organization and education. It is in these different combinations that the real educational innovations appear to be.

After devoting some thought to the different technologies and how they are being used, it occurs to us that the innovation in rural education is not computers or satellites but rather networking. It is how these technologies are linked with outside sources of educational content that will likely have the greatest influence on addressing the rural education problem as we have defined it.

Rural Schools as the Innovators

After years of following the lead of urban schools, there are reasons to expect that the educational innovation shoe may now be on the other foot, and that rural schools will lead the way in innovative applications of technology in coming years.

One reason for that expectation, is first that rural schools are small and therefore capable of being more flexible and adaptive. There is much accumulated experience in all sectors of the society to show that small organizations are more often the source of innovations than large organizations (Gellman Associates, 1982). Recently, with the state education department's Director of Curriculum Supervision, I visited a small Missouri school. We were reviewing the school's applications of computer technology. After being shown how the instructional management system had been computerized, and student performances were being used to make some substantial modifications in the curriculum, the state department director exclaimed, "It would take St. Louis five years to do that!" But we are only suggesting here that some rural schools will be leading the way in creative applications--many others will lag behind. While most creative organizations are small, not all small organizations are creative.

A reason why small organizations can be more creative is that they make it more feasible for creative individuals to have an immediate and significant impact. Regarding a rural school and its computer efforts,

one author suggests that "...it is one of the most characteristically rural things about Hillsboro-Deering that its size and culture give strong individuals an opportunity to have an immediate impact." (McDonald and Thompson, 1984). One aspect that many of the articles reporting on significant technological applications have in common is in identifying some individual--a teacher, administrator, board members, etc.--who had been largely responsible for the success that was being reported.

Another reason rural schools can be expected to lead the way is that they have a problem, unique to them, for which technology might reasonably be expected to contribute toward a solution. There is a place for computer and telecommunication technology in the curriculum of all public schools, but these technologies have the capability of delivering whole chunks of education over space in a cost effective way. It is not surprising therefore that some of the earlier uses of telecommunications technology in delivering courses have occurred in Alaska (Alaska Department of Education, 1981) and in the Australian outback (Conboy, 1983).

Rural School Experiences with Technology

Although we have reviewed a wide range of sources including the ERIC files (via DIALOG), we will not even attempt to presnt the range of

ways in which small rural schools are making use of technology. We will instead concentrate on some experiences because they either reflect general trends, or because they have produced substantial modifications to the traditional methods of curriculum delivery.

Computer Technology.

We have suggested above that there are few barriers to the diffusion of microcomputers. Those that remain for rural schools are very likely economic as suggested by Zakariya in her article "The Rich Get Computers; the Poor Get Poorer" (1984).

This is not a trivial concern, especially if technology became a more dominant mode of instruction. There are already intolerable resource gaps between rich and poor schools (including even small, rural ones) which can only become worse with high technology unless policy attention is directed to this problem. We should be viewing technology as a way of potentially reducing this gap rather than exacerbating it.

Rural schools' experience with computers range from individual schools purchasing and using them to teach about--or with--computers, to those schools that are involved in larger computer support networks such as MECC (Minnesota Educational Computer Consortium).

There appear to be two ways by which computer enthusiasm is getting produced in rural schools: (1) the "computer buff" model--as suggested by Walsh: "...the strongest conclusion that can be drawn from this study is that if a school district wants to have a good computer curriculum,

it must first have a staff and/or more computer buffs, ideally at least one in each building." (1984:38); or (2) a consortium or some other support system to provide initial and continuing in-service training. The latter is the approach taken by a consortium of six rural schools in central Missouri that joined to share employment of a full-time computer specialist who provides teacher and staff in-service training, and who helps develop instructional and management applications. (Weible, et al., 1983)

Hutchins (1982:4) observes that "to date most interest in computers has been focused on computer assisted instruction. That's a short-sighted view of the way computers will affect the life of the school..." He goes on to state that "...we must develop a vision of the way technology can improve the quality of instruction...(if not) textbook companies will simply take their existing texts and make the pages turn electronically if we don't demand something better." A part of that vision can be found among the application experiences reported by rural schools.

Although we earlier emphasized the potential of computers for networking with remote educational and informational resources, we did not find much literature on that use aside from electronic mail. What we did find, however, were numerous case studies of experiences of small schools as they incorporated computers into the classroom. What emerges is a view of what the classroom of the future might look like.

Hoachlander (1983), in a review of the adoption of computer technology in Mendocino county California schools, notes that:

> "Two characteristics stood out in those districts having the greatest success with computers: First, in the districts and schools with the strongest programs, there was a very strong commitment to computing on the part of the administration...
>
> "Second, there was a clear understanding that there is no single 'right way' to use computers, either in the classroom or administratively, and that a great deal of trial and error is required to use computers effectively."

Hoachlander joins several others in emphasizing that it is pointless to wait for the "perfect system" to arrive: it won't. Emphasis on teaching about computers (programming) should be avoided in favor of exploring the potential of this technology for a dynamic and interactional concept of education.

What one can infer from some of the written reports is that creative instructional use of computers results in a departure from the past model of the classroom with its "industrial era" emphasis on order, efficiency, structure and management. (Annison, 1982; McCune, 1982) For example, Branscombe (1982), writing about the Denver computer school, notes that "what registers on a visitor as looseness is in fact part of the school's biggest asset, i.e., its flexibility." Similarly,

McDonald and Thompson, writing about computer learning in small town New Hampshire, describe the following scene in the school's computer room:

> "...At times there are as many as four or five teachers in the room, and there are consistently at least twenty students. There are always computer aides in the room too. They are experienced computer students, who test the newly purchased software by using it, assist other students, label and sort disks, print out students' work, or just hang out. One of their main tasks is to maintain the room's schedule, but their presence, their knowledge of operations, and not incidentally, their visible interest, keep the program afloat. Pierce calls this the school-store style of management: 'School stores tend to run themselves, don't they?'" (1984:18).

Similarly, Walsh (1984) describes a situation in a rural Wisconsin school where often the teacher and students are joined in a search for a solution to a problem they think the computer might provide.

These experiences and more that could be reported suggest an evolution toward an alternative concept of what the rural classroom of the future might resemble. In fact, five years ago Fletcher suggested that:

> "...the ideal would be to have a rather different model of schooling, one which allowed a very few teachers to manage literally hundreds of students working at self-contained study centers simultaneously, on a whole variety of different programs. The remaining teachers might be generalists who planned and conducted the associated activities to each of the instructional programs but did not need to be specialists in each of the subject matter areas."

The key here is that as computers move from occupying a niche in a system based on order, structure and efficient management, to becoming a part of dynamic, individualized and interactive learning, there will be a certain degree of organizational "messiness" that goes along with it.

We expect many rural schools to have a greater tolerance for this condition than their larger counterparts. Creativity usually emerges from less, rather than more, structures situations.

Telecommunications.

As we noted earlier, CAI has a place and may even lead to substantial modifications in the future classroom, but the need in many rural areas is not merely to have certain areas of instruction assisted, but rather to provide them all!

There are several examples of where telecommunications technology, e.g. satellite transmission, low power TV (LPTV), cable networks, etc., is being dedicated to providing interactive learning in remote locations. The technology to transmit talking pictures from one location to another is not new, but some of the projects on which we'll report are incorporating new technologies that add an interactive capability.

As suggested earlier, it is not surprising that Alaska and Australia have been among the first to experiment with telecommunications technology in delivering courses. The Alaskan Education Telecommunications Project (1981) was designed more than ten years ago and has employed both telecommunications and computer technologies to meet the needs of remotely located students. Similarly,

Conboy (1983) reports on the experience in Australia in using audio bridge technology to deliver courses in the outback.

Closer to Mid-America, however, there are a couple of projects which have been using interactive television for the past several years to deliver entire courses. Eagle Bend, Minnesota is the headquarters of a project which began five years ago with a system of interactive low power television to share classes among three schools in that area. Their initial tower (transmitter) enabled the signal to reach out 25 miles, but they have recently added to the height of the tower, can now reach out 60-70 miles, and have incorporated two additional schools in the program this fall. A total of seven courses are being carried by LPTV with different courses originating in different schools, depending on the location of the most qualified teacher.

The primary studio site, main technician and broadcast equipment is located in Eagle Bend but each participating school has a broadcast tower and equipment necessary for receiving and sending television signals. The way the system works is that any particular course--say, physics--is offered at a standard time. The physics class would then be in session in the studio room each school has, with a student attendant there to operate the camera and microphones in the originating point, but pictures and audio are simultaneously being recorded at each location. Eagle Bend serves as the control room to coordinate which pictures and audio will be displayed. The consortium is now also

setting up an electronic mail system for transmission of course materials, tests, etc.

The consortium has produced a publication describing the system, which includes enthusiastic testimonials from the participating superintendents.

It is a feature of LPTV that signals can be received by any home television set within range. Russell Martinson, Superintendent at Eagle Bend, cites this as an advantage when some students are home sick, and also looks to a future where there may be more home study in the area that will include interested adults.

The initial equipment cost for the system is in the range of $250,000. The schools received outside grant assistance in covering installation of the system.

In Wisconsin's Trempeleou County, students in grades 9-12 have increased curriculum offerings because of Project CIRCUIT and a two-way television network. The Western Wisconsin Communication Cooperative connects the eight participating districts. Although planning began earlier, it was not until 1981-82 that four courses, mainly foreign languages, were offered. Substantial funding for the peoject came from outside grant funds (Armstrong, 1983).

As we have emphasized, there is also an important element of trial and error in such efforts. Colorado State University, for example, initiated the HI-TIE project a few years ago to offer public school seniors via video-tape and packaged learning materials, some courses

that are taught at the University. After some initial success, the program has been dropped this year because of lack of interest.

Putting Some of the Pieces Together

There are two projects I would like to describe as a way of concluding this paper. I have chosen these two because they not only involve state-of- the-art technology, but because the combination of rural need and the marriage of several new technologies have produced a method of providing entire courses to rural schools that are unable to offer them through traditional means (something old, something new, something borrowed, something blue). Both projects are up-to-date but also offer a vision of things to come.

I will first describe the projects and then attempt to identify some of their important elements that appear to provide a framework for a future agenda. The two projects are the Oklahoma State University (OSU) Arts and Science Public Schools Teleconferencing Network, and the Utah Department of Education Accelerated Learning of Spanish by Satellite. Oklahoma State will be going on line with a 30-week German I course on September 9; Utah will be offering a 17-week Beginning Spanish course on September 4. The Oklahoma State German course will be offered for credit by thirty Oklahoma public schools as well as some additional schools in New Mexico, Texas, Kansas and Colorado. Twenty-four Utah

public schools, two schools each in Colorado and Nevada, and one in Arkansas will be offering the Utah Spanish course for credit.

The Oklahoma course is produced and administered by the OSU College of Arts and Science. It is coordinated by Sheila Wisherd of the Dean's office. The Utah course is produced and administered by the Utah State Department of Education. Project coordinator is Ken Neal of the Utah State Department.

The two programs are similar in methodology, purpose and delivery system. Both course will be delivered by a combination of: up-link satellite, specifically designed computer programs, textbooks, and call-in assistance; they will be administratively supported by an electronic mail network. At least one year of design, testing and production work has been invested in each course. Careful attention has been devoted to fully integrating each of the technologies with each other. Both programs are intended to provide complete courses; both have clear competency-based course objectives; both have been approved for credit by their respective state departments of education.

The Oklahoma course is designed for two periods of satellite class per week, two periods of computer assisted instruction, and one period of audio bridge. The satellite presentations will be televised live from 11:30 a.m. to 12:15 p.m. daily. The "teacher" of the course is an outstanding German professor at Oklahoma State University. He has designed the course, will make the satellite presentations, and has produced the computer assisted portion. The course includes basically

the same content as German I taught at OSU. It was pilot tested with 6th through 12th grade students at Beaver, Oklahoma this past spring. Student test scores were equivalent to those achieved by OSU students during the spring semester.

The Utah course is oriented to 5th through 12th graders, and through the concept of accelerated learning is intended to produce as much competence as is ordinarily achieved in a two-year class program. Like the OSU course, this Spanish course has been designed specifically for the technologies and the methods of instruction to be employed. The primary objective is to provide students with capability to converse with native Spanish speakers. The course is structured for eighty-five 90-minute periods. The first hour of each class will be satellite instruction, which sets up the computer assisted instruction to follow each lecture. There are two "teachers" for the course--one a certified Spanish teacher, and the other a Spanish speaking performer who is close to Spanish certification. A part of the course was pilot tested with impressive results at a Utah rural school this past spring. Most significant to the evaluators was the high percentage time on task of the test students.

Both projects have scheduled a week of staff training (via satellite) to precede each of the courses. An additional feature of the Utah program is a comprehensive external evaluation that will be carried on concomitantly with the course. Evaluation will include some classroom monitoring, employing both videotape and direct personal

observation. Four different supervision situations are also being incorporated into the evaluation: (1) class supervised by a certified Spanish teacher, (2) supervised by a certified teacher who lacks Spanish competence, (3) supervised by an aide who is Spanish speaking, and (4) supervised by an aide with no Spanish background.

Both projects are also incorporating state-of-the-art technology to add features to the courses which they expect will contribute substantially to achieving the high expectations the program coordinators have for them.

Some of these features include:

(1) Cultural context.--The coordinators of both projects emphasized the importance of students' acquiring an understanding and appreciation of the cultural context of the language. The OSU project has been working with the U.S. German embassy in order to acquire additional film resources that can be incorporated in the satellite lectures. As a result, these lectures will incorporate four hours of German television commercials as well as other German origin videotapes of political, economic, cultural and historic relevance. The Utah project has had a film crew in Mexico, generating additional visual and audio materials to enhance the satellite presentations.

(2) Computer assisted instruction.--Both project coordinators emphasize that their pre-tests have shown that computer materials are essential to students acquiring language competence. Both projects are using new voice- based learning technologies to teach students proper

pronunciation. Oklahoma State University is using a voice-based learning system produced by a Texas firm which includes a voice entry terminal, and software for Apple computers. (Scott Instrument, 1985) By voice, the course instructor enters words, phrases and sentences for students to hear and repeat. The computer monitors student input until the student reaches a satisfactory reproduction of the teacher's pronunciation. A similar system is being used by the Utah project, but with a newly developed voice capability linked to IBM PC's. Both systems provide for the input to be made by the course instructor; both are generic in that they can accommodate lessons pertaining to any kind of voice reproduction including different languages, speech pathology, etc. It will be interesting to know if the students learn to speak German with an Apple accent.

Both projects include the specifically designed computer materials for participating schools. The computer materials also include some additional organized instruction, drill and practice, and testing procedures.

(3) Administration.--Both projects have incorporated an electronic mail network for administration, testing and evaluation. Since the Utah project has incorporated a strong evaluation component into the project, the designers are providing for direct classroom monitoring (via a PC XT linked to student PC terminals) which is connected by modem to the project central computer. The OSU project is also providing as a support service to participating schools an 800 number, manned eight

hours a day by senior German students at OSU, for feedback, additional conversation, student questions, etc.

Both courses have been produced specifically with the intention of helping to meet curriculum needs of small rural schools with a high quality program in a cost effective way. But it is a characteristic of the technology involved that state boundaries are no barrier to the transmission of these courses--in fact, initial subscribers for both projects include schools from several states. The Utah project coordinator emphasized that the satellite they are using provides effective coverage to the continental United States, Canada, and Mexico.

Both projects therefore are planning for the future as well. Oklahoma State University is offering an extensive enrichment program along with German this year, and is now doing the development work to offer calculus and physics in Fall, 1986. Both projects expect that there will be a wider regional and national demand for their courses and are preparing for such a demand to emerge. For this year, schools are participating in the Utah course without charge (other than their investment in necessary technology and support equipment). The project is receiving state, federal, and private sector support for its development and implementation. Support for the OSU project has come predominantly from the university, the state legislature, state department of education, and participating schools. Participating schools are sharing a part of the cost by paying a subscription fee. For this fall's German course, the subscription fee is $1550; the fee

for thirty weeks of the enrichment program is $950; they may be purchased together for $2100. The subscription fee includes the computer programs, satellite coverage, testing, staff training, and other support services. In order to participate, however, there are other one-time costs for a school--the school must have a satellite down-link and must purchase the voice entry terminals and software for the computer. The voice entry terminals and software are approximately $900 each--each can serve three to four students. If a school does not have Apple computers or video receivers, these would be additional costs.

Where To From Here

There are several features of these two projects which instructive for future applications of technology to the curriculum of small rural schools. There can be no doubt that the methods employed by these projects will change as technology changes and experience accumulates. But for the time being, they represent important steps in the direction of addressing the rural education problem we stated at the outset. We call attention to the following features of these projects as relevant to that purpose:

Multiple technologies.--Not one of the technologies we have discussed in this paper appear to be completely satisfactory for providing the range of experiences and competencies that would be

expected from a full course. While satellite transmission enables amazing global coverage from the standpoint of organized instructional experience, satellites only provide for the transmission of taking pictures--one way--a technological capability that has been here for nearly forty years. Neither have microcomputers proved to be the vehicle of instruction--yet--that many thought they would be. These two projects are integrating satellite transmission of high quality instructional material with advanced computer assisted instruction, using the computer as a network or communication device, along with in- and outside classroom interaction, to provide a comprehensive learning experience.

Collaboration.--What has been produced by these two projects simply could not be produced by an individual school. The projects represent an outcome of effective partnership among university, state departments of education, local schools, and external funding sources.

Rural schools are going to need organized assistance from multiple sources if technology is going to make a substantial contribution to the rural education "problem."

Coordination.--The potential now available for widespread adoption of courses produced in a few locations also suggests a need for attention to achieving coordination of these efforts across the country. It appears both unnecessary and excessively consumptive of resources for numerous states to duplicate the offerings of Utah and Oklahoma. Professional educator organizations, state departments, and other

agencies should be quickly addressing this emerging need for coordination. Comprehensive course technology is likely to move very quickly, especially since the support technology within the school is either generally present or within an affordable price range.

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